

Claims.

1. Apparatus for effecting controlled rotation of a body about an axis, said apparatus comprising:
 - a) a ring member or arcuate member, the centre of curvature of which is positioned at the axis of rotation of said body;
 - b) an actuator clamp mounted on said ring member or arcuate member for movement therealong, said actuator clamp being releasably clampable onto said ring member or arcuate member; and
 - c) an expansion and contraction device having two end connections that are moveable substantially towards and away from each other for a predetermined throw of said device; one of said end connections being connected to said actuator clamp; the other of said end connections being connected to said body or to a rigid arm connected rigidly to said body;whereby, (1) when said actuator clamp is clamped onto said ring member or arcuate member and said expansion and contraction device is actuated to move said end connections towards or away from each other, said body (or said rigid arm and hence said body) is rotated about said axis of rotation, and (2) when said expansion and contraction device has reached the end of its throw, said actuator clamp may be released, then moved along said ring member or arcuate member to a fresh position thereon, by the further actuation of said expansion and contraction device, so that said actuator clamp may be clamped again onto said ring member or arcuate member to permit further rotational movement of said body by further actuation of said expansion and contraction device.
2. Apparatus as defined in claim 1, in which said expansion and contraction

device is a linear expansion and contraction device.

3. Apparatus as defined in claim 2, in which a line between the end connections of said linear expansion and contraction device is above, and substantially tangential to, said ring member or arcuate member.
4. Apparatus as defined in claim 1, claim 2 or claim 3, including at least one auxiliary clamp mounted on said ring member or arcuate member for movement therealong, said at least one auxiliary clamp being releasably clampable onto said ring member or arcuate member; said at least one auxiliary clamp being connected to said body or to a respective rigid arm or projection that is rigidly connected to said body.
5. Apparatus as defined in claim 4, in which
 - (a) said expansion and contraction device is a first expansion and contraction device, and
 - (b) said at least one auxiliary clamp is connected to said body (or to a rigid arm or projection rigidly connected to said body) by a second expansion and contraction device;whereby, when said apparatus is in use, (1) said at least one auxiliary clamp is clamped to said ring member or said arcuate member shortly before said first expansion and contraction device reaches the end of its throw, and said second expansion and contraction device is activated to assist in the conclusion of the rotational movement under the control of said first expansion and contraction device and to take over the task of rotating said body while said actuator clamp is released from the ring member and moved to a new position; and (2) when said second expansion and contraction device is nearing the end of its throw, said actuator clamp is clamped to said ring member or said arcuate member

and said first expansion and contraction device is activated to assist in the final stage of the rotation of the body by the action of said second expansion and contraction device and to take over the rotation of the body while said at least one auxiliary clamp is released from the ring member or arcuate member and moved to its next position thereon.

6. Apparatus as defined in any preceding claim, in which said apparatus is controlled by a computer that is responsive to signals from a shaft encoder on said axis.
7. Apparatus for effecting controlled movement of a body along a linear member, said apparatus comprising:
 - a) an actuator clamp mounted on said linear member for movement therealong, said actuator clamp being releasably clampable onto said linear member; and
 - b) an expansion and contraction device having two end connections that are moveable substantially towards and away from each other for a predetermined throw of said device; one of said end connections being connected to said actuator clamp; the other of said end connections being connected to said body or to a rigid arm connected rigidly to said body;

whereby, (1) when said actuator clamp is clamped onto said linear member and said expansion and contraction device is actuated to move said end connections towards or away from each other, said body (or said rigid arm and hence said body) is moved along said linear member, and (2) when said expansion and contraction device has reached the end of its throw, said actuator clamp is released, then moved along said linear member to a fresh position thereon by the further actuation of said expansion and contraction device, and

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said actuator clamp is then again clamped onto said linear member to permit further rotational movement of said body by further actuation of said expansion and contraction device.

8. Apparatus as defined in claim 7, in which said expansion and contraction device is a linear expansion and contraction device.
9. Apparatus as defined in claim 7 or claim 8, including at least one auxiliary clamp mounted on said linear member for movement therealong, said at least one auxiliary clamp being releasably clampable onto said linear member; said at least one auxiliary clamp being connected to said body or to a respective rigid arm or projection that is rigidly connected to said body.
10. Apparatus as defined in any preceding claim, in which the throw of said expansion and contraction device is variable.
11. Apparatus as defined in any preceding claim, in which said member along which said actuator clamp is moveable comprises an I-beam having a centrally positioned vertical member separating an upper horizontal flange and a lower horizontal flange, and said or each clamp comprises a yoke adapted to fit onto said I-beam, said yoke comprising a pair of side members connected at the top thereof by a cross-member; characterised in that:
 - a) a respective arm extends inwardly from the lower end of each of said side members; a respective first friction pad being mounted on the top surface of each of said arms, underneath said upper flange;
 - b) a vertical shaft extends through a centrally positioned aperture in said cross-member, said shaft being freely moveable vertically within said aperture;

said actuator clamp is then again clamped onto said linear member to permit further linear movement of said body by further actuation of said expansion and contraction device.

8. Apparatus as defined in claim 7, in which said expansion and contraction device is a linear expansion and contraction device.
9. Apparatus as defined in claim 7 or claim 8, including at least one auxiliary clamp mounted on said linear member for movement therealong, said at least one auxiliary clamp being releasably clampable onto said linear member; said at least one auxiliary clamp being connected to said body or to a respective rigid arm or projection that is rigidly connected to said body.
10. Apparatus as defined in any preceding claim, in which the throw of said expansion and contraction device is variable.
11. Apparatus as defined in any preceding claim, in which said member along which said actuator clamp is moveable comprises an I-beam having a centrally positioned vertical member separating an upper horizontal flange and a lower horizontal flange, and said or each clamp comprises a yoke adapted to fit onto said I-beam, said yoke comprising a pair of side members connected at the top thereof by a cross-member; characterised in that:
 - a) a respective arm extends inwardly from the lower end of each of said side members; a respective first friction pad being mounted on the top surface of each of said arms, underneath said upper flange;
 - b) a vertical shaft extends through a centrally positioned aperture in said cross-member, said shaft being freely moveable vertically within said aperture;

- c) a first plate is securely mounted on the lower end of said vertical shaft, said first plate having a substantially horizontal lower surface; a second friction pad being affixed to the lower surface of said first plate; said second friction pad being above the top surface of said upper flange;
- d) a second plate is positioned above said first plate and below said cross member, with said vertical shaft passing through, and being freely moveable vertically within, an aperture in said second plate;
- e) a helical spring is positioned between said first plate and said second plate, said helical spring being substantially coaxial with, and surrounding the lower portion of, said vertical shaft;
- f) four bolts pass vertically through respective, symmetrically positioned, threaded apertures in said cross-member and the lower ends of said bolts bear against the upper surface of said second plate; said bolts being adjustable to control the position of said second plate relative to said cross-member, and thereby control a force applied by said helical spring to said first plate, and thus to control a force applied by said second friction pad to the top surface of said upper flange and a force applied to the underside of said upper flange by said first friction pads;
- g) a shaft lifting device is mounted on said cross-member; said shaft lifting device being actuated on receipt of a control signal to lift said shaft vertically against the force applied by said helical spring to said first plate, to thereby remove the forces applied by said friction pads to said upper flange; and
- h) at least two wheels are mounted on respective axles which extend from said yoke; each wheel being adapted to roll on the top surface of said upper flange when said shaft lifting device is actuated.

12. Apparatus as defined in any one of claims 1 to 10, in which said member along which said actuator clamp is moveable comprises a wall having a pair of side faces and a top face, and said or each clamp comprises a yoke adapted to fit over said top face; said yoke comprising a horizontal member with a pair of vertical arms extending downwardly from respective ends of said horizontal member; characterised in that
- a) a first friction pad is mounted on one of said arms, adjacent to one face of said wall, and a support plate is mounted on the inside surface of the other of said arms, said support plate having substantially planar faces which are substantially vertical;
 - b) a horizontal shaft extends through an aperture in said support plate, said shaft being freely moveable horizontally within said aperture;
 - c) a second plate is securely mounted on the end of said horizontal shaft which is remote from said support plate; said second plate having substantially planar surfaces which are orthogonal to the elongate direction of said shaft; a second friction pad being affixed to the surface of said second plate which is remote from said support plate; said second friction pad being adjacent the other face of said wall;
 - d) a third plate is positioned between said second plate and said support plate with said horizontal shaft passing through, and being freely moveable horizontally within, an aperture in said third plate;
 - e) a helical spring is positioned between said second plate and said third plate, said helical spring being substantially coaxial with, and surrounding, the portion of said horizontal shaft that is between said second and third plates;
 - f) four bolts pass horizontally through respective, symmetrically positioned, threaded apertures in said support plate so that the ends of

said bolts bear against a surface of said third plate; said bolts being adjustable to control the position of said third plate relative to said support plate, and thereby control a force applied by said helical spring to said second plate, and thus to control a force applied by said second friction pad to said other face of said wall and a force applied to said one face of said wall by said first friction pad;

- g) a shaft lifting device is mounted on said support plate; said shaft lifting device being actuated on receipt of a control signal to move said shaft horizontally against the force applied by said helical spring to said second plate, to thereby remove the forces applied by said friction pads to said faces of said wall; and
- h) at least two wheels are mounted on respective axles which extend from said yoke; each wheel being adapted to roll on the top face of said wall when said shaft lifting device is actuated.

- 13. Apparatus as defined in any preceding claim, in which said body is a large reflecting dish of a solar energy collector, mounted on a base frame.
- 14. A clamp for use with an I-beam having a centrally positioned vertical member separating an upper horizontal flange and a lower horizontal flange, said clamp comprising a yoke adapted to fit onto said I-beam, said yoke comprising a pair of side members connected at the top thereof by a cross-member; characterised in that:
 - a) a respective arm extends inwardly from the lower end of each of said side members; a respective first friction pad being mounted on the top surface of each of said arms, underneath said upper flange;
 - b) a vertical shaft extends through a centrally positioned aperture in said cross-member, said shaft being freely moveable vertically within said

aperture;

- c) a first plate is securely mounted on the lower end of said vertical shaft, said first plate having a substantially horizontal lower surface; a second friction pad being affixed to the lower surface of said first plate; said second friction pad being above the top surface of said upper flange;
- d) a second plate is positioned above said first plate and below said cross member, with said vertical shaft passing through, and being freely moveable vertically within, an aperture in said second plate;
- e) a helical spring is positioned between said first plate and said second plate, said helical spring being substantially coaxial with, and surrounding the lower portion of, said vertical shaft;
- f) four bolts pass vertically through respective, symmetrically positioned, threaded apertures in said cross-member and the lower ends of said bolts bear against the upper surface of said second plate; said bolts being adjustable to control the position of said second plate relative to said cross-member, and thereby control a force applied by said helical spring to said first plate, and thus to control a force applied by said second friction pad to the top surface of said upper flange and a force applied to the underside of said upper flange by said first friction pads;
- g) a shaft lifting device is mounted on said cross-member; said shaft lifting device being actuated on receipt of a control signal to lift said shaft vertically against the force applied by said helical spring to said first plate, to thereby remove the forces applied by said friction pads to said upper flange; and
- h) at least two wheels are mounted on respective axles which extend from said yoke; each wheel being adapted to roll on the top surface of said

upper flange when said shaft lifting device is actuated.

15. A clamp for use with a wall having a pair of side faces and a top face, said clamp comprising a yoke adapted to fit over said top face; said yoke comprising a horizontal member with a pair of vertical arms extending downwardly from respective ends of said horizontal member; characterised in that
- a) a first friction pad is mounted on one of said arms, adjacent to one face of said wall, and a support plate is mounted on the inside surface of the other of said arms, said support plate having substantially planar faces which are substantially vertical;
 - b) a horizontal shaft extends through an aperture in said support plate, said shaft being freely moveable horizontally within said aperture;
 - c) a second plate is securely mounted on the end of said horizontal shaft which is remote from said support plate; said second plate having substantially planar surfaces which are orthogonal to the elongate direction of said shaft; a second friction pad being affixed to the surface of said second plate which is remote from said support plate; said second friction pad being adjacent the other face of said wall;
 - d) a third plate is positioned between said second plate and said support plate with said horizontal shaft passing through, and being freely moveable horizontally within, an aperture in said third plate;
 - e) a helical spring is positioned between said second plate and said third plate, said helical spring being substantially coaxial with, and surrounding, the portion of said horizontal shaft that is between said second and third plates;
 - f) four bolts pass horizontally through respective, symmetrically positioned, threaded apertures in said support plate so that the ends of

said bolts bear against a surface of said third plate; said bolts being adjustable to control the position of said third plate relative to said support plate, and thereby control a force applied by said helical spring to said second plate, and thus to control a force applied by said second friction pad to said other face of said wall and a force applied to said one face of said wall by said first friction pad;

- g) a shaft lifting device is mounted on said support plate; said shaft lifting device being actuated on receipt of a control signal to move said shaft horizontally against the force applied by said helical spring to said second plate, to thereby remove the forces applied by said friction pads to said faces of said wall; and
- h) at least two wheels are mounted on respective axles which extend from said yoke; each wheel being adapted to roll on the top face of said wall when said shaft lifting device is actuated.